Evidence-based design ‘evolving fast’

March 2010

Ricardo Codinhoto, Patricia Tzortzopoulos, Mike Kagioglou, Duane Passman,

Synopsis: examine the background and history to, and advantages and disadvantages of, evidence-based design in healthcare.

The search for continuous improvement in healthcare services has stimulated different levels of discussion about how to improve the design of healthcare facilities. Improvements have been achieved at different levels by adopting numerous solutions. However there is uncertainty related to what is best in different contexts. This necessitates an evidence base to be established to better inform decisions in the healthcare domain. Another issue raising governmental and academic debate relates to whether or not substantial investments in the public service realm are delivering value-formoney. Since the pressure to justify such investment is high, the use of scientific evidence to aid decision-making has been encouraged. The systematic use of evidence to support decisions first emerged in the field of medicine, and has since been adopted in other fields, such as management and design. In relation to healthcare projects, several studies mentioned the use of evidence in supporting design decisions.1,2,3,4 These studies reported the findings based on different theoretical frameworks, and there are myriad subjects and methods that have been used to investigate the effects of the built environment on health outcomes. This knowledge domain is multidisciplinary in nature, and contributions have been made in different fields, ranging from medical to engineering research. Although there are certain implications of adopting evidencebased design (EBD) in practice, these have not been investigated extensively. In this respect this paper discusses several aspects related to the practice of EBD in healthcare projects. For that purpose an extensive literature review was conducted on the relationship between healthcare environments and health outcomes. In addition, workshops with designers, healthcare planners, and project managers, were carried out to support the arguments presented. Preliminary results show there are difficulties related to the collection and compilation of evidence, as well as its implementation throughout the project lifecycle. The idea of using evidence to inform decision-makers in design is, of course, not new in the context of healthcare buildings. Early in the 1960s the UK National Health Service (NHS) began developing Health Building Notes (HBNs) and Health Technical Memoranda (HTMs) with a basis on evidence. Since then those documents have been updated with current scientific findings and good practices. In addition there are more recently developed tools to support EBD, such as the NHS Environmental Assessment Tool (NEAT), Achieving Excellence Design Evaluation Toolkit (AEDET Evolution), and A Staff/Patient Environment Calibration Tool (ASPECT).

The evidence-based approach

Using scientific evidence to support decision-making is a simple and powerful concept. In medicine, for instance, this approach has been used to decide on the best treatment alternative for the patient. This involves identifying, for example, which treatment has the shortest healing time; which ones cause the least

sideeffects and impact least on patients' quality of life, and which ones are most affordable.5 The search for evidence in the evidencebased approach in general requires the use of systematic literature reviews. These follow pre-determined, rigorous steps that strengthen the searching process. Although systematic reviews are generally time-consuming, the results usually lead to identification of rigorous research studies and/or knowledge gaps. Additionally, following a systematic approach improves trackability, allowing the process to be replicated, therefore improving the reliability of the search.5,6 The opportunity to learn lessons from similar cases and apply such knowledge in real contexts has attracted the attention of many professionals. As a result, the evidence-based approach has been adopted in other areas, including education,7 economics,8 management,6 and design.9 As in evidence-based medicine, the aim of EBD is to achieve better-informed design decisions. EBD is defined as "the deliberate attempt to base building decisions on the best available research evidence with the goal of improving outcomes, and of continuing to monitor the success or failure for subsequent decision-making".9 The principles of EBD follow the principles established in medicine. However, unlike evidence-based medicine, the full application of systematic reviews in design is limited. Research methods are simply limited in terms of gathering knowledge from such a complex and dynamic phenomenon. In addition, the lack of explicit cause and effect relationships, and the fragmentation and sparseness of the knowledge base, also affect the adoption of the evidencebased approach.10,11

Interconnected issues

In fact, these issues are interconnected, and may be related to the fact that, until recently, evidence has not been applied in such a direct manner into practice. Therefore it is clear that most of the current reported scientific findings are not consistent with the evidence-based approach. The adoption of such an approach requires that information is structured in a detailed manner, allowing the decision-maker to draw comparisons. In healthcare, for instance, EBD started being explored with its application to the initial phases of the design process. That means that reported evidence of design solutions impacting positively (or negatively) on healthcare delivery has been considered within design. Several relationships have been investigated in relation to healthcare buildings, including improved healing environments, better working conditions for staff, and improved experience for visitors. Other dimensions were also examined, such as sustainability, accessibility, and cost-effectiveness. The built environment, as one of the determinants of health outcomes, has been depicted in many different ways. There are various types of facilities, care units, and settings, where research was conducted. Investigations are focused on the constituent parts of the environment, such as the fabric defining the envelope (e.g. material and texture), the ambient (e.g. light, noise, temperature, humidity and air), design (e.g. shape, dimensions, layout, colour and art), and the psychological aspects that are related to these (e.g. wayfinding, safety and accessibility). An extensive list of variables, as well as the relevant references, can be found in the science review: "The effects of the built environment on health outcomes".10 It was not until recently that the concept of EBD evolved and started being considered throughout the lifecycle of a facility. This can be achieved by embedding the EBD within a Benefits Realisation12 process. While

evidence is used to support decision-making at the initial stages of design, it is also collected for verification and validation of the decisions undertaken. In relation to redevelopments, this approach requires that results are monitored before, and after, decisions are implemented. In other words, Trusts willing to adopt this approach must have a list of problems that they want to tackle by improving their facility, and a baseline of their current performance, so that they can measure results and verify the effectiveness of their decisions. This includes the measurement of both tangible and intangible benefits.

Identifying 'critical decisions'

As the concept of EBD has evolved, issues related to its implementation in practice started to emerge. For example, the design process requires making a large number of decisions; hence it would be impractical to base all decisions on academic evidence. This means that critical decisions to be supported by the approach should be identified. In addition, the application of EBD implies the undertaking of activities not previously considered within a conventional design process. Thus roles and responsibilities for carrying out these additional activities must be clarified.13 In relation to the compilation of evidence, whose responsibility is it to gather and analyse such evidence? Despite the fact that existing literature reviews reduce the amount of work to be done, in large healthcare projects some complementary work might still be necessary. In this case a third party can be contracted to complete the evidence base. That was the case with St. Joseph's Healthcare Hamilton (a multi-site, regional tertiary, academic health science centre in Ontario in Canada), where the design team outsourced the research at 0.33% of the construction cost.14 There is also the issue related to the ownership of the EBD process, and the long time-span of healthcare projects. For example the elaboration of the Strategic Outline Case (service re-design) of the £200 million redevelopment of the Salford Royal Hospital in the UK started in 2000, and the full operation of the new facilities is predicted to start in 2012. Nine of the 12 years have passed, and services, governance, and decision-makers, have already been changed within this project.15 For the evidence-based approach, it is important that people take ownership of the process of collecting evidence to measure the impact of the decisions made at initial stages.

Discussion

For all the features explicitly, or implicitly, incorporated within the evidence-based approach it is possible to pinpoint some issues and doubts that might emerge from those willing to adopt it. The first relates to the question of whether or not EBD solves all healthcare-related problems. The immediate answer to this question is no. Healthcare delivery is complex. There are issues related to the impacts of healthcare facilities on patients, but these are, of course, only one of the variables that have an impact on health. Others include the treatment route adopted, and the condition of the patient. For instance, patients' fall rates can be reduced by using appropriate floor covering or sized doors. However, regardless of the features of the floors and the doors, patients might still fall due to their weak muscles, especially in the case of elderly.

A false expectation

Secondly, there is a false expectation that the adoption of the evidence-based approach provides answers for all the trade-offs related to design. All trade-offs have positive and negative consequences, and designers and healthcare planners are still required to judge what is best within the project context – for example, to resolve the trade-off between increased durability and increased cost and lifecycle, or reduced durability, but reduced costs and lifecycle, in the design of a toilet facility within a healthcare unit. If the former approach is adopted, the final solution may be a toilet lasting for 20 to 25 years. Although no refurbishment may be needed over this period, there is a significant risk that, towards the end of it, patients and staff may not be satisfied with the out-of-date facility. The latter approach, on the other hand, may lead to cheaper upfront costs, but with the added inconvenience of regular refurbishment being needed on a busy healthcare site.

Readiness for decision-making

Thirdly, is the evidence base ready for decision-making in the design of healthcare facilities? The number of studies related to the impacts of healthcare facilities on users has increased considerably in the last decade. In the UK, HBNs, HTMs and design tools started being up-to-date, with state-of-the art evidence, and these series of documents provide some guidance for the design of healthcare facilities. However, there remains an issue as regards the lack of transparency as far as the source of evidence used to support such guidelines is concerned. The same problem occurs in relation to tools in which evidence is not explicit. In addition, the descriptive aspect of the evidence base has begun to be more effectively deployed in guiding designers, either via the generation of evidence-based models and the creation of detailed maps of research in this field, or through the use of sophisticated IT systems such as building information modelling (BIM) packages. Since sound organisational strategy is essential during healthcare projects, the final issue is the roles and responsibilities of those individuals involved in adopting an evidence-based approach. Throughout the development process many clients and stakeholders are involved, including designers (architects and engineers), the project management team, the construction team, the Trust, strategic health authorities, patients, and staff groups. Their involvement with the project varies considerably, and all of them contribute to the successful implementation of the evidence-based approach.

Conclusions

EBD is an approach to support decisionmaking strongly founded on the use of state-of-art evidence. The use of evidence is important for critical decisions where a set of vital information about the impact of design solutions on users and maintenance may influence the way design evolves. Disconnected pieces of evidence should not be mistakenly used as EBD to justify bias within design solutions. Rather evidence should support decisions and, wherever possible, designers and healthcare planners should collect relevant information from completed projects in order to validate their decisions. In other words, the efficiency and effectiveness of their decisions should be monitored in terms of improving the quality and use of the space. There are currently limitations in terms of maximising the utilisation of EBD. These relate principally to the lack of understanding about cause and effect relationships linking the built environment

and its impacts on users, the fragmentation and sparseness of the knowledge base, and the lack of guidance regarding roles and responsibilities related to the adoption of EBD. However, EBD is evolving fast, with a rapidly growing body of evidence, and the more cases are reported, the clearer the implications of adopting it will become.

References

1 Evans G.W., McCoy J.M. (1998), "When buildings don't work: the role of architecture in human health", Journal of Environmental Psychology, Vol. 18, p.85-94.

2 Lawson B., Phiri M. (2003), "The architectural healthcare environment and its effects on patient health outcomes: a report on an NHS estates funded project", London, NHS Estates and University of Sheffield: 22.

3 Joseph A. (2006), "The impact of the environment on infections in healthcare facilities", The Centre for Health Design: 1.

4 Ulrich R., Zimring C., Zhu X., DuBose J., Seo H., Choi Y., Quan X., Joseph A. (2008), "A review of the research literature on evidence-based healthcare design", Health Environments Research & Design Journal, Vol. 1, No. 3, p.61-125.

5 Mulrow C.D. (1994) Systematic Reviews: Rationale for systematic reviews. BMJ 309 (6954): 597-599.

6 Tranfield D., Denyer D., Smart P. (2003) Towards a methodology for developing evidence-informed management knowledge by means of systematic review. British Journal of Management 14: 207-222.

7 Reed D. et al. (2005). "Challenges in Systematic Reviews of Educational Intervention Studies." Ann Intern Med 142 (12_Part_2): 1080-1089.

8 Pignone M. et al. (2005). "Challenges in Systematic Reviews of Economic Analyses." Ann Intern Med 142 (12_Part_2): 1073-1079.

9 Malkin, (2008) A visual reference for evidence-based design, The Center for Health Design.

10 Codinhoto R., Tzortzopoulos P., Kagioglou M., Aouad G., Cooper R. (2008). "The effects of the built environment on health outcomes", Research Report, HaCIRIC (Health and Care Infrastructure Research and Innovation Centre).

11 Codinhoto R., Tzortzopoulos P., Kagioglou M., Aouad G., Cooper R. (2009) "The effects of the built environment on health outcomes". Facilities, Vol. 27 No. 3/4, pp. 138-151.

12 Sapountzis S., Yates K., Kagioglou M., Aouad G. (2009) Realising Benefits for Primary Healthcare Infrastructures, Facilities, Vol. 27 No.3/4, pp.74-78, March 2009

13 Zimring C., Augenbroe G.L., Malone E.B., Sadler B.L. (2008) Implementing healthcare excellence: The vital role of the CEO in evidence-based design.

14 Edelstein E.A., Pitts F.M. (2008) Neuroscience & architecture: Evidencebased design in practice… lessons learned. Presentation: CHD AAH 2008, Washington DC.

15 Tzortzopoulos P., Codinhoto R., Kagioglou M., Koskela L.J. (in press) The gaps between healthcare service and building design: a state of the art review. Revista Ambiente Construído (Built Environment journal)